

words, it would give a dispersion equal to that given by 36 equilateral prisms of heavy flint glass. It will be understood that the light is taken twice through the double battery, returning at a higher level, after exactly the same fashion as in the battery described by Mr. Grubb in the December number of the *Monthly Notices*.

Observations of Mars, with Drawings.

By John Joynson, Esq.

The accompanying drawings of the planet *Mars*, as it has been seen during the late opposition, are arranged so as to exhibit its aspect at regular intervals of thirty-seven minutes. There are, in consequence, four more in number than those in the sets already sent to the Society for the oppositions of 1862, 1864, and 1867; but they can be easily compared with them, as there has been but little change in the appearance of the planet since the last opposition.

It will be noticed that the aspect of the planet is entirely changed in about ten diagrams, or about every six hours, showing that we can only see about one-fourth of the planet, or about half the true disk at one time; about one-eighth on each limb is hidden by the rotundity of the planet. This is confirmed by the fact that the aspect changes slower at the neighbourhood of the limbs than the same part does when it gets about the centre of the disk. The present arrangement enables any one to see at once what parts are on opposite meridians, as one hemisphere is represented by twenty diagrams.

The planet has been apparently tilted over, so as to bring the North Pole more directly towards us, though the effect is more perceptible on the southern limb than about the pole itself. The North Polar snow has been of much smaller extent than it was at the last opposition, and has had very much the appearance of that at the South Pole, as seen in 1862. It has not been quite on the limb, as it has appeared somewhat larger on one side than on the opposite: though it has sometimes, even on both, appeared perfectly round, owing to its smallness and brightness. There is only one other remark to make as to any apparent change on the disk, and that is, that the watery projection from the North Polar snows seen about the 22nd March has been much larger than at the last opposition; indeed the whole disk about the pole has been darker than previously.

The general colour of the disk (saving the band and the channel from it to the circumpolar waters) has been yellowish, with a brownish tinge towards the pole. But it is difficult to say what the real colour is, for the same part of the disk has varied from night to night from dark-yellow to very nearly white, according to the state of our own atmosphere.

These drawings, in conjunction with those previously sent, prove beyond doubt that the "band" and "wine-glass shaped channel" from it, are permanent features of the planet, and that any apparent change in them arises from the various aspects that are presented by the planet itself, as seen from the Earth.

In addition to the above set of drawings, I send copies of those already sent for the oppositions in 1862, 1864, and 1867, arranged so that the corresponding drawing for each appears under that for the previous opposition, thus showing the apparent changes, and facilitating their comparison.

Waterloo, near Liverpool, 10 May, 1871.

On a Free-Regulator Clock. By Sidney B. Kincaid, Esq.

The common pendulum-clock is essentially a very imperfect adaptation of theory to practice, because, while the theory contemplates a body swinging under the action of a *constant* force, in practice it is influenced by forces so various that it is only with the utmost difficulty that a clever workman can render their sum approximately constant in a clock of moderate size, and when the requirement that it should drive a pair of large hands on a weather-dial necessitates construction on a scale belonging rather to the province of the engineer, it is deemed indeed a triumph of skill to produce a timepiece which can be depended on as such for any lengthened period without frequent correction by the transit-instrument.

I would now submit to the Royal Astronomical Society a plan in which, by making the regulator mechanically free of the going and recording apparatus, the difficulty of construction I have referred to is obviated, inasmuch as a slight want of care and accuracy in the finish of these latter parts of the clock does not tend to impair the exactness of its performance.

I propose, as will be seen, to substitute for the pendulum as the controlling agency, iron spheres falling *in vacuo*, and to record the falls and replace the spheres by means of a galvanic current. No doubt some unaccustomed to its use may feel prejudiced against the employment of electricity, but with a self-amalgamating Smee, or a constant, battery, there need be no much trouble about it.

In the diagram:—

A, is the case, exhausted of air to prevent unequal resistances due to changes of temperature.

B, a wheel (C its support) on the axis of which and connected to it is a pinion, such that if $\frac{1}{t}$ be the fraction of a second occupied by the falling of a ball, $60 t$ turns of B make one turn of seconds-wheel of clock. To the edge of B is fixed by a loose pin,